

PATENT APPLICATION
Attorney's Do. No. 1941-70

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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In re application of: Paul J. BRUINSMA; Suresh BASKARAN; and
Jagannadha R. BONTA and Jun LIU

FEB 05 2004

Serial No. 09/481,988

Examiner: P. Marcantoni

Filed: January 11, 2000

Group Art Unit: 1755

Original Patent No. 5,922,299

Original Patent Issue Date: July 13, 1999

For: MESOPOROUS-SILICA FILMS, FIBERS, AND POWDERS BY EVAPORATION

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P.O. Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF
(PATENT APPLICATION - 37 C.F.R. § 1.192)

1. Transmitted herewith in triplicate is the APPEAL BRIEF in this application, with respect to the Notice of Appeal filed on December 5, 2003.
2. This application is on behalf of other than a small entity.
3. Pursuant to 37 C.F.R. § 1.17(c), the fee for filing the Appeal Brief is \$320.
4. The total fee due is \$320.
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Respectfully submitted,

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I hereby certify that this Appeal Brief and Appendix to Appellant's Brief are being transmitted to the U.S. Patent and Trademark Office via facsimile number (703) 872-9306, on February 5, 2004.

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Judy Wigmore
Judy Wigmore

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APPEAL BRIEF under 37 C.F.R. §1.192

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Dear Sir:

In support of the appeal to the final rejection of the claims in the above-referenced application, appellants respectfully submit the following brief.

Statement of the Real Party in Interest under 37 C.F.R. §1.192(c)(1)

The real party in interest is the party named in the caption of the application.

Status of Related Appeals and Interferences under 37 C.F.R. §1.192(c)(2)

No other appeals or interferences are pending with regard to this application.

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Status of all Claims less than 37 C.F.R. §1.192(c)(3).

Claims 129-189 are presented in this case. Claims 1-128 have been canceled. Claims 129-187 have been allowed by the Examiner. Claims 188 and 189 have been finally rejected by the Examiner and are on appeal in this case.

Status of Amendments under 37 C.F.R. §1.192(c)(4)

No amendments after the final rejection dated October 6, 2003, have been filed.

Summary of the Invention under 37 C.F.R. §1.192(c)(5)

As this patent application is a reissue, references to the specification and references to the parent patent will be made in terms of the column and line numbers of the parent patent, US Patent No. 5,922,299.

This invention is directed towards formation of mesoporous thin films and structures by a process of combining a precursor with a solvent, a catalyst and a surfactant (see column 4, lines 17-25, for example, or column 15, lines 1-10), and either forming them into a perform (see column 6, lines 57-63) or dispensing the precursor onto a substrate (see column 8, lines 12-24). The solvent is then evaporated (column 4, lines 1-16), and the resulting film is heated (column 7, lines 1-5). The heating may be at a temperature high enough to cause the film to become calcined (column 18, lines 56-65).

Statement of Issues Presented for Review under 37 C.F.R. §1.192(c)(6)

Claims 188 and 189 have been rejected as being unpatentable under 35 USC 251 as an improper recapture of the claimed subject matter deliberately canceled in the application for the parent application upon which the present re-issue is based.

Statement of the Grouping of Claims under 37 C.F.R. §1.192(c)(7)

All claims stand independently.

Arguments

Claims 188 and 189 have been rejected as being unpatentable under 35 USC 251 as an improper recapture of the claimed subject matter deliberately canceled in the application for the parent application upon which the present re-issue is based.

History

The original patent issued on July 13, 1999 with claims 1-15. This patent application was filed on January 11, 2000, in which claims 26-62 were added. An office action was mailed on June 7, 2000, and Appellants added claims 63-71 in a response dated July 13, 2000. An office action was mailed on August 10, 2000, and Appellants responded on November 16, 2000, adding claims 72-75 and canceling claims 36 and 68. A final office action was mailed on December 7, 2000, to which Appellants responded with an amendment after final on December 29, 2000, canceling claims 61-68. An advisory action was mailed on January 12, 2001, to which Appellants responded with a second amendment after final on February 7, 2001, adding claims 78-115, and canceling claims 28-39, 72-77 and 42-57. Another advisory action was mailed on March 9, 2001, to which Appellants responded with a request for continued examination (RCE) on April 9, 2001.

An office action was mailed on May 21, 2001, to which Appellants responded on August 21, 2001, canceling claims 89, 96-97, 99-108 and adding claims 116-121. A final office action was mailed on October 25, 2001, to which Appellants responded with an amendment after final on December 10, 2001. A first advisory action was received on December 14, 2001, to which the Appellants responded with a second amendment after final on February 15, 2002, adding claims 122-128. An advisory action was received on February 22, 2002, to which Appellants responded with an RCE on March 27, 2002, requesting that the previous amendment after final be entered.

An office action was mailed on April 4, 2002, to which Appellants responded with an amendment on July 8, 2002. A final rejection was mailed on July 16, 2002, to which Appellants

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responded with a notice of appeal and an appeal brief on September 9, 2002. The Examiner re-opened prosecution and issued a non-final office action on November 27, 2002, to which Appellants responded with an amendment and added claims 116-127. The Examiner issued an advisory action on April 3, 2003, which resulted in a phone call between the Examiner and Appellant's representative on April 8, 2003, as the previous office action was non-final.

Upon the Examiner's request, Appellants filed a supplemental response on April 10, 2003, in which all pending claims were canceled in favor of newly added claims 129-188, which were a renumbering and re-alignment of the previous claims. During prosecution the dependent claims were not grouped numerically with the independent claims, so the renumbering was to situate the dependent claims numerically with their independent claims. An office action was mailed on June 25, 2003 pointing out a formatting problem with the previous response, as well as some other issues. Appellants responded with a response on September 25, 2003, renumbering the previously added claims with underlining, and adding claim 189. On October 6, 2003, a final office action was mailed, in which claims 129-187 were allowed, and claims 188 and 189 were rejected. This is the final office action to which Appellants responded by filing a notice of appeal, which is the instant appeal.

In the original patent application of the parent case, claims 25-27 and 28 were presented. These claims were the subject of a restriction requirement. Appellants canceled those claims and did not file a divisional application to capture those claims. For the Board's convenience these claims are reproduced below:

25. A mesoporous silica powder having a plurality of particles comprising:
said plurality of particles in a size range are hollow spheres with mesopores therein.
26. The particles as recited in claim 25, having a diameter of at least 1 micron.
27. A mesoporous silica product, comprising:
a fiber having a diameter of at least 5 microns with mesopores therein.

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28. A calcined mesoporous silica film on a substrate comprising a d-spacing less than 40 angstroms.

After filing the re-issue, Appellants mistakenly attempted to present those claims, but canceled them in the second amendment after final on February 7, 2001. This was in response to the Examiner's final rejection of December 7, 2000, as being impermissible recapture. Applicants had presented claims 28-31 in the current application, where claims 28-30 corresponded directly to claims 25-27 of the parent application, and claim 31, reproduced below was newly added.

31. A calcined mesoporous silica film on a substrate formed by a process comprising any one or more of the steps including spin coating, dip coating and evaporation.

The non-elected claims 25-27 were composition of matter claims having limitations relating to particle size and shape. Claim 27 is a "product" claim having a structural limitation relating to fiber diameter and limited to a silica product formed by any process having one or more of three recited steps (dry spinning, fiber drawing and rapid evaporation). Applicants accept, for this argument, that the Examiner correctly offered an alternative method to form the product of claim 27 in the parent restriction, i.e., sol-gel or precipitation. Claim 31 similarly is a composition of matter claim (silica film) formed by any process that includes one or more of "spin coating, dip coating and evaporation." Again, Applicants herein accept for purposes of argument that the Examiner properly recited an alternative method for making the "product" of claim 31, i.e., chemical vapor deposition, brushing, immersion in a container with the coating of silica material, etc.) in the parent restriction. As mentioned above, these claims were canceled in the response of February 7, 2001.

It must be noted that, prior to the renumbering of claims in the response filed April 10, 2003, claim 188 claims the same subject matter as 128 did prior to the amendment submitted on March 27, 2003. The amendment to claim 128 had been done with the understanding that the

amendments would make claim 128 allowable. (See Advisory Action, Paper No. 31, April 3, 2003, "Claim 128 is allowable and case is in condition for allowance pending re-submission of amendment renumbering claims (emphasis added).") Upon submission of the response requested by the Examiner in that advisory action, Appellants renumbered the claims and submitted the supplemental response in April, 2003. It was in the office action of June, 2003, that the Examiner raised the argument that claim 188 was impermissible recapture and withdrew the previous indication that it was allowable.

Claims 188 and 189

Appellants submit that 1) the subject matter of claims 188 and 189 are not the same as the non-elected claim 28; 2) that claims 188 and 189 are part of the same invention as the allowed process claims.

Claims 188 and 189 do not claim the same subject matter as non-elected claim 28.

Upon inspection of claim 28 above and claims 188 and 189 set forth in the Appendix, it becomes clear that the subject matter of these claims is very different. Claim 28 claims a calcined, mesoporous thin film having a certain d-spacing. Claims 188 and 189 are directed to calcined, mesoporous thin films produced by a particular and very specific process.

In the Final Rejection, dated October 6, 2003, it was stated that "Pending claims 188 and 189 are the same subject matter as originally presented claim 28. All these claims are directed to a calcined, mesoporous silica film on a substrate." However, pending claims 188 and 189 are product-by-process claims that are analogous to claim 156, with the added step of calcining.

It is unclear to Appellants as to whether the objection is in part based upon the term 'calcining' in the pre-amble. However, allowed claim 129 in combination with its dependent claim 152 would result in a calcined, mesoporous silica material. Claim 129 in combination with claim 137 would result in the mesoporous silica material being a thin film. Similarly,

allowed claim 167 includes calcining to form a mesoporous structure.

Regardless of the Examiner's interpretation of the term calcining, it is apparent that the films claimed in claims 188 and 189 are vastly different subject matter than the film claimed in non-elected claim 28. Claim 28 was directed to a calcined, mesoporous thin, film having a particular d-spacing. Claims 188 and 189 are directed to a calcined, mesoporous thin film manufactured by a particular process, and the process is the subject matter of already-allowed claims. Therefore, the presentation of claims 188 and 189 is not an attempt to re-capture the subject matter of claim 28.

Claims 188 and 189 are part of the same invention as the allowed process claims.

Claims 188 and 189 are product-by-process claims, which are proper and are part of the same invention as the current process claims. As stated in the MPEP § 2173.05(p)I:

"There are many situations where claims are permissibly drafted to include a reference to more than one statutory class of invention. A product-by-process claim, which is a product claim that defines the claimed product in terms of the process by which it is made, is proper." *In re Moeller*, 117 F.2d 565, 48 USPQ 442 (CCPA 1941); *In re Luck*, 476 F.2d 650, 177 USPQ 523 (CCPA 1973); *In re Steppan*, 394 F.2d 1013, 156 USPQ 143 (CCPA 1967); and *In re Pilkington*, 411 F.2d 1345, 162 USPQ 145 (CCPA 1969). See MPEP 2173.05(p).

As mentioned above, claims 188 and 189 are analogous to the process claim 156 and similar to the process claim 159. Claim 159, when combined with its dependent claim 163, results in a mesostructured film that is calcined. Claim 188 and 189 merely claim the film formed by those processes. As stated above this is permissible and part of the same invention as the allowed process claims, not the invention that was restricted out in the parent case.

In their response submitted on September 25, 2003, Appellants stated that had claims 188 and 189 been submitted in the parent case, they would not have been subject to a restriction requirement. Appellants should have more clearly stated that the claims would not have been properly subject to a restriction requirement. The Examiner responded that, as he was the

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original Examiner in that case, they would have been subject to the restriction requirement.

It was also stated that "The applicants (Appellants) did not traverse nor attempt in any manner to traverse the original restriction..." This is true. Appellants did not traverse the restriction requirement made at the time in the parent application. The subject matter of these claims was not present in the claims that were the subject of the restriction requirement. If these claims had been presented in the parent application, and were subject to a restriction requirement, Appellants would have objected to the restriction requirement with traverse, as Appellants do not believe that these claims are directed to a different invention. The subject matter of these claims is the same invention as the allowed process claims. Therefore, these claims should be treated as being part of the same invention as the already-allowed claims, and the Examiner's rejection should be reversed.

The argument presented that "product by process claims do not patentably distinguish the product of reference even though made by a different process..." is directed to patentability over the prior art. *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985). The Examiner has made a general statement that "ceramic materials can be made by sol-gel, organometallic synthesis, and solid state sintering and the ceramic material formed in all cases is the same." However, to apply *In re Thorpe*, referenced above, the Examiner would have to be arguing that the product-by-process claims of the instant application are obvious over the prior art. The Examiner has not made a prior art rejection of these claims, so *In re Thorpe* does not apply.

In contrast, Appellants submit that the product-by-process claims are part of the same invention as the process claims, are therefore properly included in this application and should be ruled allowable.

Having shown that claims 188 and 189 are not attempting to recapture non-elected subject matter from the parent case, and that they are properly part of the invention claimed in the allowed process claims, Appellants request that the Examiner's final rejection of these claims be reversed.

Respectfully submitted,

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I hereby certify that this Appeal Brief and Appendix to Appellant's Brief are being transmitted to the U.S. Patent and Trademark Office via facsimile number (703) 872-9306, on February 5, 2004.

Signature

Judy Wigmore
Judy Wigmore

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APPENDIX TO APPELLANT'S BRIEF
UNDER 37 CFR §1.192

Dear Sir:

The claims on appeal in the above-referenced application are reproduced below. While only claim 188 and 189 are on appeal, Appellants' brief refers to other of the claims that have also been included below.

1-128 Canceled.

129. (Allowed) A method of making mesoporous silica materials, comprising the steps of

(a) combining a silica precursor with an aqueous solvent, an acid and a surfactant having an ammonium cation into a silica precursor solution,

(b) templating the silica precursor with the surfactant and obtaining the mesoporous material from the templated silica precursor,

(c) forming said silica precursor solution into a preform; and

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(d) rapidly evaporating said aqueous solvent from said preform for obtaining the mesoporous material, wherein the improvement comprises:

(i) providing said aqueous solvent in an amount resulting in complete hydrolysis and providing said acid in an amount maintaining a hydrolyzed precursor and avoiding gelation or precipitation; and

(ii) providing said surfactant and said silica precursor in a mole ratio that is above a lower mole ratio that produces a non-porous silica phase and below an upper mole ratio that produces a lamellar phase.

130. (Allowed) The method as recited in claim 129, wherein said lower mole ratio is about 0.05.

131. (Allowed) The method as recited in claim 129, wherein said upper mole ratio is about 0.3.

132. (Allowed) The method as recited in claim 129, wherein said acid is added in an amount resulting in a pH of said silica precursor solution of from about 1 to about 4.

133. (Allowed) The method as recited in claim 132, wherein said pH is about 2.

134. (Allowed) The method as recited in claim 129, wherein the step of forming includes diluting with an alcohol.

135. (Allowed) The method as recited in claim 134, wherein said alcohol is ethanol.

136. (Allowed) The method as recited in claim 129, wherein said aqueous solvent, said acid, and said surfactant are premixed before combining with said silica precursor.

137. (Allowed) The method as recited in claim 129, wherein said mesoporous materials are in a geometric form selected from the group consisting of fiber, powder, and film.

138. (Allowed) The method as recited in claim 129, wherein said forming is spin-casting.

139. (Allowed) The method as recited in claim 129, wherein said forming is spraying.

140. (Allowed) The method as recited in claim 129, further comprising adding a pre-polymer or a polymer to said silica precursor solution making a pituitous mixture.
141. (Allowed) The method as recited in claim 129, wherein said forming is drawing.
142. (Allowed) The method as recited in claim 129, wherein said forming is squeegeeing.
143. (Allowed) The method as recited in claim 129, further comprising the step of adding a metal compound to the silica precursor solution.
144. (Allowed) The method as recited in claim 143, wherein said metal compound is selected from the group consisting of metal halide, metal nitrate, and combinations thereof.
145. (Allowed) The method as recited in claim 144, wherein said metal halide is a metal chloride.
146. (Allowed) The method as recited in claim 144, wherein said metal is selected from the group of aluminum, iron and combinations thereof.
147. (Allowed) The method as recited in claim 129, wherein said silica precursor is an alkoxide silica precursor or a tetrachlorosilane.
148. (Allowed) The method as recited in claim 129, wherein said aqueous solvent amount is characterized by a ratio of said aqueous solvent to said silica precursor of about 7.
149. (Allowed) The method as recited in claim 129, wherein said acid amount is characterized by a ratio of said acid to said silica precursor of about 0.1.
150. (Allowed) The method as recited in claim 129, further comprising adding a swelling agent to the silica precursor solution.
151. (Allowed) The method as recited in claim 150, wherein said swelling agent is 1,3,5-trimethylbenzene.
152. (Allowed) The method as recited in claim 129, further comprising the step of calcining the mesoporous material.

153. (Allowed) A method of making a mesoporous silica film, comprising the steps of

- (a) combining a silica precursor with an aqueous solvent, an acid and a surfactant having an ammonium cation into a silica precursor solution,
- (b) templating the silica precursor with the surfactant and obtaining the mesoporous material from the templated silica precursor,
- (c) forming said silica precursor into a preform; and
- (d) rapidly evaporating said aqueous solvent from said preform for obtaining the mesoporous material, wherein the improvement comprises:

- (i) said silica precursor is tetraethoxysilane;
- (ii) providing said aqueous solvent in a superstoichiometric amount and providing said acid in an amount maintaining a hydrolyzed precursor and avoiding gelation or precipitation;
- (iii) providing said surfactant and said silica precursor in a mole ratio that is above a lower mole ratio that produces a non-porous silica phase and below an upper mole ratio that produces a lamellar phase; and
- (iv) said forming includes diluting with an alcohol.

154. (Allowed) The method as recited in claim 153, further comprising adding a pre-polymer or a polymer to said silica precursor solution making a pituitous mixture.

155. (Allowed) The method as recited in claim 153, wherein said rapidly evaporating is by spin-casting.

156. (Allowed) A method of making a mesoporous film on a substrate, the method comprising the steps of:

- (a) combining a silica precursor with an aqueous solvent, an acid catalyst and an ammonium cationic surfactant into a precursor solution;

- (b) dispensing said precursor solution onto the substrate;
- (c) forming a film by evaporation of the solvent in less than 5 minutes; and
- (d) heating the film on the substrate to a temperature sufficient to decompose the

surfactant, thereby producing a mesoporous film on the substrate.

157. (Allowed) The method of claim 156 wherein the precursor solution is a silica precursor solution and wherein the surfactant and the silica precursor solution are in a mole ratio that is above a lower mole ratio that produces a non-mesoporous silica phase and below an upper mole ratio that produces a lamellar phase.

158. (Allowed) The process of claim 156, wherein the film exhibits an index of refraction between 1.16 and that of silica.

159. (Allowed) A process to form mesostructured films, comprising:

- (a) preparing a precursor sol containing a soluble source of silica, an aqueous solvent, an ammonium cationic surfactant and an acid catalyst; and
- (b) depositing the precursor sol on a substrate wherein evaporation of solvent and water in less than 5 minutes causes the formation of said mesostructured films on the substrate surface.

160. (Allowed) The process of claim 159 wherein the aqueous solvent and the catalyst are provided in amounts that maintain a hydrolyzed precursor sol while avoiding gelation or precipitation.

161. (Allowed) The process of claim 159 wherein the soluble source of silica is a silica precursor alkoxide or tetrachlorosilane and wherein the surfactant and the soluble source of silica are in a mole ratio that is above a lower mole ratio that produces a non-porous silica phase and below an upper mole ratio that produces a lamellar phase.

162. (Allowed) The process of claim 159, wherein the ammonium cationic surfactant further includes alkyl triethylammonium chloride or bromide surfactants with different chain lengths.
163. (Allowed) The process of claim 159, further comprising the step of calcining said film at 450°C.
164. (Allowed) The process of claim 159, wherein the precursor sol is deposited on a substrate by spin coating.
165. (Allowed) The process of claim 159, wherein said soluble source of silica is an alkoxide silica precursor or tetrachlorosilane.
166. (Allowed) The process of claim 159, wherein the films exhibit an index of refraction between 1.16 and that of silica.
167. (Allowed) A process to form a mesoporous structure, comprising:
- (a) preparing a precursor sol containing a soluble source of silica, an alcohol and water solvent, an ammonium cationic surfactant, and an acid catalyst, wherein said solvent is provided in an amount resulting in complete hydrolysis and said acid catalyst is in an amount to maintain a hydrolyzed precursor and to avoid gelation or precipitation in said precursor sol;
 - (b) forming the precursor sol into a preform;
 - (c) evaporating said solvent from the preform at a rate that forms a mesostructured material; and
 - (d) calcining the mesostructured material to form a mesoporous structure.
168. (Allowed) The process of claim 167, wherein said precursor sol contains alcohol which is a byproduct of hydrolysis, and said mesoporous structure is a film.
169. (Allowed) The process of claim 167, wherein said preform is a droplet, said alcohol is a byproduct of hydrolysis, and said sol is spray dried to form a powder.

170. (Allowed) The process of claim 167, wherein said drying is performed in less than 5 minutes.
171. (Allowed) The process of claim 167, wherein said precursor sol contains dilutant alcohol, and wherein the mesoporous structure is a film.
172. (Allowed) The process of claim 167, wherein the mesoporous structure is a film and wherein the film exhibits an index of refraction of between 1.16 and that of silica.
173. (Allowed) The process of claim 167, wherein the said precursor sol contains alcohol which is a byproduct of hydrolysis, and wherein said mesostructure is a film.
174. (Allowed) The process of claim 173, wherein the film exhibits an index of refraction of between 1.16 and that of silica.
175. (Allowed) The process of claim 167, wherein said preform is a droplet, wherein said alcohol is a byproduct of hydrolysis, and wherein said precursor sol is spray dried.
176. (Allowed) The process of claim 167, wherein said evaporating is performed in less than 5 minutes.
177. (Allowed) The process of claim 167, wherein said soluble source of silica includes a silica alkoxide precursor or tetrachlorosilane.
178. (Allowed) A process to form a mesoporous structure, comprising:
- (a) preparing a precursor sol containing a soluble source of silica, an alcohol and water solvent, an ammonium cationic surfactant, and an acid catalyst, wherein said solvent is provided in an amount resulting in complete hydrolysis and said acid is in amount to maintain a hydrolyzed precursor and to avoid gelation or precipitation in said precursor sol;
 - (b) forming the precursor sol into a preform;
 - (c) evaporating said solvent from the preform at a rate that forms a mesostructured material, wherein said mesostructured material contains surfactant; and

(d) calcining the mesostructured material to form a mesoporous structure.

179. (Allowed) A process to form a mesostructure, comprising:

(a) preparing a precursor sol containing a soluble source of silica, water and alcohol solvent, an ammonium cationic surfactant and an acid catalyst; and

(b) evaporating said solvent in less than 5 minutes to cause the formation of a mesostructure, wherein said mesostructure contains surfactant.

180. (Allowed) The process of claim 179, wherein the mesostructure is a film, and wherein the film exhibits an index of refraction of between 1.16 and that of silica.

181. (Allowed) A process to form a mesostructure, comprising:

(a) preparing a precursor sol containing a soluble source of silica, a water and alcohol solvent, an ammonium cationic surfactant and an acid catalyst, and

(b) evaporating said solvent in less than 5 minutes to cause the formation of a mesostructure.

182. (Allowed) The process of claim 181, wherein said solvent is evaporated in less than 1 minute.

183. (Allowed) The process of claim 181, wherein said solvent is evaporated in less than 10 seconds.

184. (Allowed) The process of claim 183, wherein the mesostructure is a film, and wherein the film exhibits an index of refraction of between 1.16 and that of silica.

185. (Allowed) The process of claim 181, wherein the said precursor sol contains both dilutant alcohol and alcohol which is a byproduct of hydrolysis, and wherein said mesostructure is a film.

186. (Allowed) The process of claim 181, wherein said preform is a droplet, said alcohol is a byproduct of hydrolysis, and said sol is spray dried.

187. (Allowed) The process of claim 181, wherein the ammonium cationic surfactant further includes alkyl triethylammonium chloride or bromide surfactants with different chain lengths.

188. (On Appeal) A calcined mesoporous silica film on a substrate formed by a process comprising:

dispensing an acid catalyst- and silica precursor- and aqueous solvent- and surfactant-containing solution on the substrate;

forming a film on the substrate by rapid evaporation of the solution on the substrate;

heating the film on the substrate for a time and to a temperature sufficient substantially to remove any residual solvent; and

calcining the film at a temperature at or above 350°C.

189. (On Appeal) A calcined mesoporous silica film on a substrate formed by a process comprising:

dispensing a catalyst- and silica precursor- and solvent- and surfactant-containing solution on the substrate;

forming a film on the substrate by rapid evaporation of the solution on the substrate; and

heating the film on the substrate for a time and to a temperature sufficient substantially to remove any residual solvent; and

calcining the film at a temperature at or above 350°C.

Respectfully submitted,

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